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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/528,262	03/17/00	DEN BAARS S	585-27-009

EXAMINER
BAUMEISTER, B

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or pr ceeding.

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1- File Copy

PTO-90C (Rev. 2/95)
*U.S. GPO: 2000-473-000/44602

Office Action Summary

Application No.	Applicant(s)
09/528,262	Denbaars et al.
Examiner	**Art Unit**
William Baumeister	2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a).. In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Jul 16, 2001* .

2a) ☐ This action is **FINAL.** 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-29* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *Mar 17, 2000* is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☐ All b) ☐ Some* c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)

16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

17) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). *3, 7-9*

18) ☐ Interview Summary (PTO-413) Paper No(s). _____

19) ☐ Notice of Informal Patent Application (PTO-152)

20) ☐ Other:

DETAILED ACTION

Drawings

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, a substrate doped with iron as well as with Cr, Ti and Co (see claim 15) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Claim Objections

2. Claims 2, 10, 12 and 14 objected to because of the following informalities. Appropriate correction is required.

a. Claim 2, line 5 recites "at a predetermined wavelength is [sic: in] response to..."

b. Claim 10, lines 3 and 4 recite "said device comprises the light emitting from at least one of said active layers or the light emitting from at least one of said active layers..."

c. Claim 12 recites: "wherein each [sic: of] said active layer [sic: layers]..."

d. Claim 14 recites: "such that it absorbs said active layers, light and re-emit more than one color of light."

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 2, 4, 7 and 10-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a. Claim 2 recites the limitation "comprising at least one said active layers" in lines 1-2. There is insufficient antecedent basis for this limitation in the claim because claim 1 from which claim 2 depends only sets forth "an active layer" (singular).

b. Claim 4 recites the limitation "wherein said active layers" (plural) in lines 1-2. There is insufficient antecedent basis for this limitation in the claim because claim 1 from which claim 2 depends only sets forth "an active layer" (singular).

c. Claim 7 (depending from claim 1) recites the limitation "wherein said sapphire..." in lines 1-2. There is insufficient antecedent basis for this limitation in the claim.

d. Further in claim 7, the phrase "such as" renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention. See MPEP § 2173.05(d).

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who

has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

6. Insofar as definite, claims 1-7, 10, 14, 20 and 24-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Kaneko '901. Kaneko discloses various III-N LED and LD emitters formed on doped semiconductor substrates for absorption and re-emission of a second wavelength from the substrate which is different than that emitted from the emitter. The emitter may emit more than one wavelength (col. 10, lines 11-15). These wavelengths may or may not include the wavelength of the pumping light (the light that pumps the substrate activator centers) (col. 10, lines 29-36). The semiconductor substrate may be of various materials including sapphire (col. 3, lines 10-15). Various dopants or activators may be employed including Cr, Ti and Co (col. 3, line 15). The substrate may be uniformly or non-uniformly doped and a plurality of dopants can be utilized (col. 3, lines 15-20). Various wavelengths including white light can be selectively generated (col 3, lines 45-50; col. 10, lines 30-36).

7. Claims 25-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Birkhahn et al. '669 (provided in IDS #9). Note particularly EXAMPLES 4-7 disclosed therein where Pr-doped GaN films grown on sapphire are excited by UV lasers and, in turn, emit red light. In other words, the active layer of the laser transmits a UV optical emission at least to the doped semiconductor film and the semiconductor film transmits an emission of a different wavelength.

8. Claims 25-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Russell et al. '941. Therein, a group IV emitter (such as amorphous Si) is formed on a generally transparent substrate, which may be composed of various materials specifically including ruby (i.e, an SOS emitter). Note the discussion relating to FIG 3 wherein the reference discloses that the emission peak of the solid line corresponds to the luminescence of the Cr impurities (col. 6, lines 45-50).

a. Russell states:

> A photonic stimulation source is schematically depicted for photoluminescence, it being understood that suitable electrode or other appropriate means would be suitably disposed to assure a responsive electronic stimulation for electroluminescent...
>
> Additional insulating, semi-insulating or conducting layers may be added to the light emitting photonic silicon layer on the sapphire substrate in accordance with the particular job at hand, as will become readily apparent to one skill in the art to which this invention pertains (col. 4, lines 29-40).

However, this disclosure does not clearly set forth that the amorphous Si emitter includes clad layers as required by claim 1, so absent some secondary evidence not currently of record teaching that amorphous Si emitters either may or inherently possess clad layers, Russell does not anticipate at least claim 1.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 8, 9, 11-13, 16-18, 21 and 22 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Kaneko '901 as applied to the claims above. Kaneko sets forth examples of GaInN emitters that can emit in the range of 400 - 550 nm (violet - green) (col. 4, lines 9-25). This specific example does not include UV or yellow wavelengths. However, the disclosure is not limited to this example. Rather, Kaneko broadly discloses that the emitter may be any of various III-V nitride emitters (e.g., col. 3, lines 20-25 and 40-45). This includes AlGaN emitting in the UV range and high In-content GaInN, which can be set to emit yellow or even the orange/red wavelengths. As such, the disclosure anticipates these claims.

a. Alternatively, assuming *arguendo* that the reference must be read so narrowly so as to fail to actually disclose UV or yellow emitters, the claims would nonetheless have been obvious over Kaneko. Given that Kaneko does teach III-N emitters emitting one or more wavelengths, some or all of which is absorbed by the substrate and re-emitted as one or more secondary wavelengths, and in light of the fact that it was well known to those of ordinary skill in the art at the time of the invention to provide III-N emitters that can emit single or multiple wavelengths variously in the UV to orange-red range, it would have been obvious to one of ordinary skill in the art at the time of the invention to employ an III-N LED emitting any specific one(s) of these wavelengths (i.e., selectively setting the composition of an AlGaInN active layer)

depending only on the ultimate specific colors desired. Further with regard to the UV emitters, it was well known to those of ordinary skill in the art at the time of the invention to employ UV emitters whose light is re-emitted as different visible colors for various reasons such as to prevent age-dependent color shifting of the device.

b. Regarding claims 16-18, Kaneko discloses that the optical crystal substrate may include a plurality of dopants and may be uniformly or non-uniformly doped (col. 3, lines 15-20). Kaneko further teaches that the electroluminescent light source can be configured to emit more than two wavelengths (multiple active layers) which may or may not include the wavelength of the pumping light, and that these different wavelengths may be used independently (selectively) (col. 10, lines 30-45).

11. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaneko as applied to the claims above in view of Birkhahn et al. '669. Kaneko discloses that the substrate may be doped with combinations of various rare earth or transition metal impurities including but not limited Cr, Ti and Co. However, Kaneko does not expressly state that iron is one of the impurities that may be employed.

Even assuming *arguendo* that it was not well known to those of ordinary skill in the art at the time of the invention independent of the Birkhahn teachings that iron impurities in substrates such as sapphire would emit blue light upon being activated by a UV light source, Birkhahn teaches that wide band gap semiconductor substrates doped with elements with partially filled

inner shells such a rare earth elements and transition metals (e.g., Fe) can be formed and will emit in the visible and UV spectrum at a wide range of temperatures (col. 1, lines 40-). Given this disclosure, it would not require undue experimentation for one skilled in the art to determine the specific color emitted by each of the transition metals under these circumstances, and thereby determine that Fe emits a blue light. Accordingly, it would have been obvious to one of ordinary skill in the art at the time of the invention to further include iron impurities in the substrate for any of various purposes such as for altering the resultant hue of the blue emitted by the substrate, or for supplementing the blue-emitting titanium with relatively less expensive Fe impurities to reduce manufacturing costs.

12. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaneko as applied to the claims above, and further in view of Applicant's Admitted Prior Art. Kaneko discloses that that invention--wherein at least part of the light emitted from an emitter is absorbed by a doped substrate and re-emitted as a different color--can generate light with various wavelengths including white light and that it may be utilized for various applications including display devices (col. 3, lines 45-51). Kaneko does not disclose the further use of a downconverting material around the surface of the LED.

Nonetheless, Applicant admits that it was known at the time of the invention to employ downconverting material (such as a phosphor, polymer or dye) surrounding the LED which absorbs blue light and re-emits yellow light to form white light (Specification, BACKGROUND,

page 2). It would have been obvious to one of ordinary skill in the art at the time of the invention to further include a downconverting layer with the Kaneko invention for the purpose of increasing the number of colors emitted by the Kaneko device without requiring the additional manufacturing costs associated with the growing of additional active layers, or alternatively for the purpose of further altering the ultimate color emitted from a given batch of LEDs depending upon the specific lighting application of that particular batch, thereby enabling LEDS having a given bandgap (color) to be employed in a larger array of color applications. This would have been particularly true in those applications in which the device is already intended to be surrounded by an encapsulant for protection from the environment, since the downconverting material could then be incorporated into the encapsulant.

13. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaneko as applied to the claims above. Regardless of whether Kaneko discloses further circuitry integrated on the same substrate, it was well known to those of ordinary skill in the art at the time of the invention that one of the main goals of the semiconductor industry is to integrate various components and circuits on a common substrate to enable better miniaturization. It was further well known that one of sapphire's benefits is its additional use for growing silicon-on-sapphire (SOS) circuits. (See US Patent Class 257, Subclass 352: Active Solid-State Devices/Field Effect Device/Single crystal semiconductor layer on insulating substrate (SOI)/Substrate is single crystal insulator (e.g., sapphire or spinel). Thus, it would have been obvious to one of ordinary skill in the art at the

time of the invention to provide further circuitry on the same substrate at least for the reasons set forth hereinabove.

INFORMATION ON HOW TO CONTACT THE USPTO

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister,** at **(703) 306-9165.** The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

B. William Baumeister

July 30, 2001

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